ALKOXIDE GEL NANOFILM CRACKING PROCESSES FOR CREATING OF NOVEL STRUCTURES

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Low-dimensional IVB group metal oxide materials are of great interest due to the applications in photocatalysis, electronics, high temperature isolation and solar cells industry. The elaboration of different strategies for the synthesis of micro- and nano-scale oxide materials is essential for improving the properties and finding new applications for these materials.

We have reported a novel phenomenon and mechanism of low-dimensional tubular oxide structure formation [1]. This discovery provides a new methodology for direct, non-template method for preparing microtubular structures of HfO_2, ZrO_2 and TiO_2. Deposition of solvent free metal alkoxide polymer layer on glass substrate and exposing it with controlled amount of humid atmosphere leads to self-formation of gel film segments that have a tendency for spontaneous rolling upon adding a proper solvent that dissolves the sol under the gel layer.

The purpose of our work is to explain the formation phenomenon of above-mentioned tubular oxide structures, to visualize it in real time in order to reach a better understanding of the processes and control the shape and size of obtained microstructures. The character of gel nanofilm cracking is influenced by various parameters like temperature, ambient humidity, rate of solvent evaporation and presence of nano- and micro-scale defects. Current work includes:

- Achieving control over solvent evaporation rate, temperature and ambient humidity.
- Visualization of crack propagation in alkoxide gel films resulting formation of film segments by optical microscope and scanning electron microscope. Videoclips of the process will be demonstrated.
- Preliminary modelling of the process.

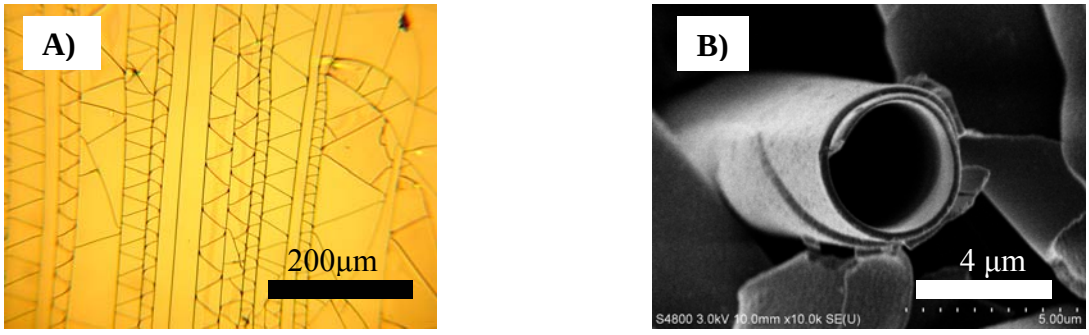

Fig.1 Metal alkoxide gel film cracking: A) optical microscope image of cracking of gel segments, B) SEM image of rolled up gel-segments.

[1] V. Reedo, M. Järvekülg, A. Lõhmus, U. Mäeorg, Novel route for preparation of tubular TiO_2 microstructures, *phys. stat. sol. (a)* 2008, 205, 6, 1511-1514.